RESEARCH ARTICLE

Leadership epistemology

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Abstract. The study of leadership is characterized by an expanding set of definitions of the term *leadership*. Some scholars even set out to know leadership by the identification of traits or behaviors of good leaders. However, the scientific study of leadership requires the identification of a causal theory of leadership. The scientific belief in causation as the common epistemology is the necessary link between the various disciplines interested in leadership (e.g., organizational psychology, statistics, education, or management studies), which allows for the interdisciplinary study of leadership.

Keywords: leadership science, epistemology, causal theory, interdisciplinary

Leadership epistemology

The field of leadership studies now encompasses a variety of research methods (Horner, 1997; Gambrell, Matkin, & Burbach, 2011). A leading figure in the field, Bernard Bass, once famously wrote in this respect: "There are almost as many different definitions of leadership as there are persons who have attempted to define the concept" (Bass, 1990, p. 11). The phenomenon of an ever-expanding number of hypotheses within a social science, such as leadership, is not at all unique, however. Several decades ago, Lawrence Summers (1991) identified a similar phenomenon in the field of economics. In the study of macroeconomics, it turned out that very few of the hypotheses proposed by economists were ever truly subjected to testing and potential falsification (Anderson & Dewald, 1994). This is also a serious problem for the nascent field of leadership studies if it is to be considered in the nature of *scientific inquiry*. The great flood of hypotheses about leadership needs to be somehow narrowed down or systematized. The methodology of "science" actually means in part the narrowing and falsification of hypotheses (Popper, 1935/2002, p. 10). However, the professional rewards for a scholar in inventing a new definition or theory of leadership are often higher than merely testing prior ideas of leadership. And, in general terms, scholarship that prioritizes the development of new theory is the preferred approach. Science means the process of falsification (or supplementing) of theory with a better theory (Popper, 1935/2002, p. 58). We want the best and brightest scholars in the field of leadership studies (or the study of anything else) working on the development of new theories on the respective subject. But, we also need a means to distinguish a better theory when it arises so as to know when to abandon outdated ideas. The idea of testing or falsifying theories leads to the need for epistemology, where epistemology means an ability to distinguish between competing ideas about leadership. In the field of leadership studies, there are many epistemologies (or competing approaches to "knowing" things) such as psychology, statistics, management, and so forth. The objective of this paper is to systematize existing theories of leadership under a common framework or epistemology.

The idea of defining leadership

Bass (1990) referred to a variety of "definitions" of leadership. Likewise, Horner (1997) referred to a variety of "theories" of leadership. A definition of leadership is in this respect akin to a theory of leadership. Any scholar who sets out to define leadership is setting out to provide a framework to know leadership. If we observe many competing definitions of leadership, that is to say that we do not have an agreement on the epistemology of identifying leadership (in other words, we do not agree how to know it). Many textbooks on the subject of leadership thereby begin by first identifying a definition of leadership, which, at minimum, reflects the epistemology the author of the textbook sets out to apply in the study of leadership (Northouse, 2010).

The University of Warwick (2012) has compiled a rather astonishing list of definitions of leadership (Appendix A). The proposed definitions range from each of the following: (a) leadership as a process of influencing activities of an organized group (Stogdill, 1950), (b) the initiation and maintenance of leaders and followers (Hollander, 1978), (c) a process of influencing a group toward goal achievement (Hersey & Blanchard, 1988), (d) the development of a system of expectations toward usage human and other resources (Batten, 1989), (e) and a form of art in mobilizing others to want to struggle for shared aspirations (Kouzes & Posner, 1995). Perhaps the most cited definition of leadership in the field was given by Burns (1978) with the antonymic ideas of transforming versus transactional leadership. These definitions were then revised to emphasize transformational leadership, incorporating and not excluding elements of transactional leadership (Bass, 1990). To add an additional layer of complexity, various business magazines often publish anecdotal accounts of leadership, which are typically given in the form of new adjectives or metaphors used to describe leaders (Elite Business Magazine, 2014).

The problem as developed here is that such definitions of leadership generally do not constitute a workable epistemology. The reason for this is that the definitions do not set out to describe leadership *causation* specifically. The definition of leadership is a theory of its causal elements. An epistemology of leadership science would instead involve a causative theory of leadership itself. The presupposition of defining to know leadership indicates a situation where there is no agreement on the applicable epistemology of leadership science among scientists working in the field. Absent a workable method of identifying leadership, various disciplines within the field of leadership studies will compete for supremacy by asserting their own method exclusively (Kuhn, 1962). For example, psychologists working in the field of leadership studies will use the methods of psychology, whereas statisticians in the same field may use empirical datasets, each claiming their respective method is superior. If the results are inapposite on some important question relevant to leadership, then a conflict arises between the disciplines within leadership studies. As such, this article sets out to provide a basic epistemology for the study of leadership as science. The benefit of an identifiable epistemology for leadership science is the potential to systematize existing theories of leadership under a common scientific framework premised on causation common to all fields. This research method reflects what is often referred to as interdisciplinary research. Scholarship without an agreed epistemology depends in significant part on adjectives which may vary greatly between disciplines (McCloskey, 1983; Rorty, 1979).

Causation

The special characteristic of scientific inquiry is that science deals with identifying causation (Popper, 1935/2002, p. 27). Leadership as science means identifying the causal factors for leadership. And, that means not doing what Horner has characterized as simply describing the "traits, qualities, and behaviours of a leader" (Horner, 1997, p. 270). Put bluntly, just describing things in this fashion is not scientific inquiry absent an accompanying theory of causation. This is counterintuitive because scientists seem to describe results in the laboratory

all the time. Most of what laboratory scientists do on a daily basis seems to be describing the results of experiments; however, the description of experimental results involves the testing of a theory about leadership and not deriving it solely from empirical observations (Popper, 1935/2002, pp. 7, 76). The introductory point is that science requires a theory of causation and not just description.

Perhaps the simplest means of explaining why science is concerned with causation of events in the world is by reference to mysticism as an alternative to modern science. If we are merely engaged in describing observable events, then bird-signs are a possible means to explain the causation of events a person may not truly understand. For example, I might observe correctly and accurately that before every battle of Alexander the Great a black crow was seen holding a pine branch in its beak. Let us assume that this observation is entirely true. If Alexander wins every battle following the observation of the black crow with the pine branch in its beak, then it might seem like a good idea to have a priest look for a crow with a pine branch before committing the army to battle. This is how mysticism works as epistemology. Mysticism lacks any attempt at an explanation of causation to modern eyes because neither the priest nor his audience really has any idea at all about causation as we now understand cause and effect. The priest reports that black crows seem to determine the outcome of battles through the intervention of the gods or any other unknown factor. In the study of leadership behavior by mysticism, we might say then that black crows with pine branches actually cause leadership results, and we know this by observation and experience.

The idea of leadership studies as merely describing the various traits of leadership studies is roughly the same idea in proceeding to purportedly know something without referring to causation (Popper, 1935/2002, p. 39). Since the field of leadership studies has in large part relied on identifying certain beliefs or characteristics of individuals that may result in leadership, it is important to emphasize that the categorizing of descriptions is not without value in determining causation (Nailon, Dalgish, Brownlee, & Hatcher, 2005). As an illustration, we know that George Patton wore pearl-handled revolvers and Steve Jobs wore turtleneck shirts. The observation of such things is not scientific inquiry, but it may lead to the development of a theory about causation. Hence, science is the explaining of why and not just the describing of empirical observations. A series of singular empirical observations is not a theory of science until the causative element is identified. The scientific method proceeds by identifying a theory of causation in the form of a hypothesis and then to refine it by testing to a better theory. Science does not posit determinative facts and then render conclusive hypotheses from these facts. The colloquial idea of science as scientists engaged in laboratory testing of facts is an end-stage in the scientific process involved with the evaluation of hypotheses.

A remarkable aspect of the study of the human science is that it could be true that black crows with pine branches in their beaks in fact cause leadership results. That is, if the entire army believes in the mysticism (e.g., believes in Patton´s pearl-handled revolvers) then it may in fact become the causal element. Even if that were true, however, the causal element would then be the morale of the troops as influenced by the mysticism and not the crow itself. Furthermore, since the preferences and beliefs of human subjects change over time (a concept referred to as *ergodicity*), it may be that black crows with pine branches caused leadership in Alexander´s time, but this is no longer true today, and a modern audience may thus find such an explanation of leadership absurd.

The role of facts

A scientist trained in the natural sciences might argue that any theory of leadership is metaphysics, not physics, and therefore, not science at all. The underlying idea is that scientific theories deal with empirical things in the world (e.g., theoretical physics) and non-science theories deal with things not observable in the world (e.g., morality). Only the theory of empirical things can be physics and therefore science. Popper (1935/2002) referred to this

critique as empiricists "calling metaphysics names" (p. 16). In this view, leadership would be taken merely as an ephemeral characteristic of persons that can never really be known, or that it is entirely contingent (Gardner, Avolio, Luthans, May, & Walumbwa, 2005). Since leadership behavior actually occurs in the world, it follows that leadership science is a theory about observable events (i.e., a social science) and not metaphysics. Science is not exclusively the measurement of human behaviors, however. Scientific experimentation is the evaluation of pre-existing theories about human behaviors. The argument that leadership is metaphysics and cannot be science is to say that there is no possible epistemology of leadership, in other words, a theory of leadership causation that could be subject to testing. However, the existing theoretical groundwork in the field of leadership science introduces, at minimum, the potential for an epistemology of leadership based on a general theory of leadership. As a social field involving the study of human behavior, leadership science is, in this regard, as much real as economics.

The general confusion with the colloquial view of science is accepting that science does not offer absolute certainty based on observable facts. Facts are not things that exist in the world apart from science; according to Popper (1935/2002), science does not function merely to verify the existence of an observable reality. The role of facts is within a theory, which is the subject of scientific testing. Accordingly, the Popperian approach to scientific discovery entails first and foremost the rejection of an empiricist methodology, where the idea is to inductively build a scientific understanding of leadership from singular observations (Popper, 1935/2002, p. 24).

As such, a scientific theory never rests on empirical "bedrock." The search for bedrock is what empiricists are attempting to achieve, for example, by deducting from logical syllogisms an idea of leadership. Popper (1935/2002) described this as an inductive method in part because it turns out to be impossible to say exactly what constitutes "pearl"-handles or a "turtleneck," as illustrations. He wrote:

> Science does not rest upon solid bedrock. The bold structure of its theories rises, as it were, above a swamp. It is like a building erected on piles. The piles are driven down from above into the swamp, but not down to any natural or "given" base; and if we stop driving the piles deeper, it is not because we have reached firm ground. We simply stop when we are satisfied that the piles are firm enough to carry the structure, at least for the time being (Popper, 1935/2002, p. 94).

In the modern era of the social sciences, particularly with regard to econometrics, the concern is not mysticism but a version of the Baconian scientific method, where hypotheses arise from empirical observation in laboratories or by dataset analysis with computers (Bacon, 1653/1964). Rather, scientific inquiry is the search for causation, or the explaining by theory of events in the world. If a clinician engaged in the study of leadership develops a hypothesis that leadership relates to clothing (e.g. turtlenecks), it can perhaps then be tested. Every scientific theory may be considered sufficient when it is adjudged sufficient by the members of the scientific community, which is also the general statement of the modern Bayesian theory of science (Ulen, 2002).

A causal leadership epistemology

Leadership science is not the empirical observation of a trait in leaders and then presenting the observations in a spreadsheet and conducting a regression analysis to say what traits predict leadership behavior. Rather, leadership science is, in the first place, setting forth a theory about leadership that establishes the epistemology of leadership. That theory could be tested or refined with the empirical observation of leaders presented in a spreadsheet with a regression analysis to show that the general theory of leadership is flawed in some way. As a matter of Bayesian science, that test would then form the basis for the introduction of an auxiliary hypothesis to the general theory, for example. However, a regression analysis study

of a given dataset does not set forth the hypothesis, test it, and provide conclusive proof of its own hypothesis. This approach, typified by the field of econometrics, represents a misunderstanding of the scientific method, which involves the analysis of theory. By science, we should expect to see a systemization of theories and not mathematical proofs.

The elements of a general theory of leadership are proposed here as the following:
1. Object Person (i.e., prospective leader),
2. Subject Group (i.e., one or more other persons including the Object Person),
3. Project (i.e., human endeavor) that can only be achieved by the Subject Group,
4. Adversity (i.e., natural or artificial opposition to the Project), and
5. Decisive Effect (i.e., the project would have failed outright or rendered worse).

To conceive of a general hypothesis is to describe the causal relations in a manner that can be narrowed with the introduction of auxiliary hypothesis. The formulation of the general theory of leadership is as follows:

Proposition 1: The Object Person relates to the Subject Group.
Proposition 2: The Subject Group undertakes the Project.
Proposition 3: The Project is subject to Adversity.
Proposition 4: The Adversity is mitigated with Decisive Effect.

The general theory of leadership: An Object Person causes the Subject Group to proceed with a Project despite Adversity with Decisive Effect.

The advantage of setting forth an epistemology as propositions is that subsequent objections can be evaluated with regard to the relevant component of the proposition. If the theory is not broken down into sub-parts, it is difficult to analyze differences between competing theories of leadership.

Proposition 1. The Object Person relates to the Subject Group

The first proposition is the relation of the leader to the group. The classic illustration is where a leader gives orders to subordinates, such as in the military. In that case, the relation between subject and object is given by orders. However, that is not true of all leaders. As Greenleaf (1977) pointed out, the relation could occur by a person not in command of the group. The relative success of leaders under this proposition might be analyzed with the methods of psychology.

Proposition 2. The Subject Group undertakes the Project

The second proposition of leadership is that the group actually undertakes what the leader has proposed as the project. One means to evaluate leadership is to determine if the leader is capable of getting others to follow *at all*. The relative success of leaders under this proposition might be a function of gravitas, for example, or other personal characteristics of the leader.

Proposition 3. The Project is subject to Adversity

The third proposition entails leadership as requiring the experience of difficulty or adversity, at least broadly defined. As an example, the organization of co-workers to go to lunch together does not appear to be something that should fit into the mold of leadership. The relative success of leaders under this proposition might be analyzed with the methods of organizational design or, simply put, the process of assignment of roles within an organization.

Proposition 4. The <u>Adversity</u> is mitigated with <u>Decisive Effect</u>

The fourth proposition is that the leader relates to the group so as to encounter the adversity and overcome it in decisive fashion. This factor might be analyzed by identifying the best person for the leadership role as a technical matter, for example, a highly-educated leader representing the person with the relevant skillset who may be more likely to cause the group to act with decisive effect.

Illustrations of causal leadership epistemology

(1) George Patton-as-Leader Hypothesis.

 Proposition 1: <u>George Patton</u> commanded the <u>U.S. 2nd Armored Division</u>.
 Proposition 2: The <u>U.S. 2nd Armored Division</u> undertook the <u>Relief of Bastogne</u>.
 Proposition 3: The <u>Relief of Bastogne</u> was subject to military <u>Opposition</u>.
 Proposition 4: The Patton/2nd Armored relation was <u>Decisive</u> to overcome the military
  <u>Opposition</u>.

Leadership Hypothesis: <u>George Patton</u> caused the <u>U.S. 2nd Armored Division</u> to undertake the <u>Relief of Bastogne</u> despite military <u>Opposition</u> with <u>Decisive Effect</u>.

(2) Steve Jobs-as-Leader Hypothesis.

 Proposition 1: <u>Steve Jobs</u> was in charge of the <u>Employees of Apple</u>.
 Proposition 2: The <u>Employees of Apple</u> undertook the <u>I-Phone</u>.
 Proposition 3: The <u>I-Phone</u> was subject to <u>Supply-Chain Problems</u>.
 Proposition 4: The Jobs/Employees of Apple relation was <u>Decisive</u> to overcome <u>Supply-
  Chain Problems.</u>

Leadership Hypothesis: <u>Steve Jobs</u> caused the <u>Employees of Apple</u> to proceed with the <u>I-Phone</u> despite <u>Supply-Chain Problems</u> with <u>Decisive Effect</u>.

(3) George McClellan-as-Leader Hypothesis.

 Proposition 1: <u>George McClellan</u> commanded the <u>Union Army of the Potomac</u>.
 Proposition 2: The <u>Union Army of the Potomac</u> undertook the <u>Peninsular Campaign</u>.
 Proposition 3: The <u>Peninsular Campaign</u> was subject to <u>Opposition by Robert E. Lee´s
  Army of Northern Virginia</u>.
 Proposition 4: The McClellan/Union Army relation was <u>Decisive</u> to overcome <u>Opposition
  by Robert E. Lee´s Army of Northern Virginia</u>.

Leadership Hypothesis: <u>George McClellan</u> caused the <u>Union Army of the Potomac</u> to proceed with the <u>Peninsular Campaign</u> despite <u>Opposition by Robert E. Lee´s Army of Northern Virginia</u> with <u>Decisive Effect</u>.

The necessity for falsifiers in science

In scientific inquiry, the potential for falsification is a good thing. If the conclusion is not rendered as subject to some doubt, then we have essentially a religion. The falsifiers need not be accepted and are simply illustrative that science does not rest on bedrock or is not in the nature of religious belief (Popper, 1935/2002, p. 93). Since here we are applying a general theory of leadership to several of the quintessential examples of leadership (e.g., Patton and Jobs), it will appear as near tautology but, with respect to George McClellan, where the leadership classification is dubious, the leadership hypothesis is subject to substantial doubt. Furthermore, any falsifiers will appear more or less plausible depending on the strength of the underlying hypothesis. To illustrate potential falsifiers, illustrations are given here with respect to the leadership behavior hypothesis of George McClellan as follows: First is an

inductive falsifier that nearly all of McClellan´s strategies employed in military campaigns in the Civil War (including the Peninsular Campaign) resulted in failure. Second is an abductive falsifier that McClellan´s army heavily outnumbered the opponent and should have prevailed relatively easily. Third is an empirical falsifier that the Union Army decisively lost the Peninsular Campaign. To the extent these falsifiers are persuasive, then we might doubt the proposed hypothesis that McClellan acted with leadership.

A few illustrations of non-science

Non-science is often reflected in a methodology in which it is difficult to identify the proposed hypothesis as may be reflected in a claim to certain or unquestionable results. Some of these methods are observable in the field of economics. The following is a list of non-scientific methods, each presented with a short example: (a) Non-science by simple deduction (e.g., the relief of Bastogne operation required military leadership; therefore, George Patton engaged in military leadership); (b) Non-science by simple empirics (e.g., George Patton wore pearl-handled revolvers; therefore, leadership results from pearl-handled revolvers); (c) Non-science by empirics plus induction (e.g., leaders are statistically more likely to wear solid color clothes; therefore, solid color clothes cause leadership); (d) Non-science by empirics plus deduction (e.g., all leaders actually wear solid color clothes; therefore, solid color clothes cause leadership); and (e) Non-science by psychoanalysis (e.g., a leader makes a statement; then good things happen; therefore, leadership results must be caused by the statement).

All leaders are __[x]__ (e.g., All leaders are brave)

The lay inductive, and hence non-scientific, approach to the study of leadership is to use adjectives to essentially label and arrive at the meaning of the word *leadership*. An example would be to describe leaders as "brave," "determined," or "smart." The advantage of Popper´s (1935/2002) approach to science should be plainly apparent when taken in comparison to this method of simply making lists of adjectives. Bass (1997) presented the idea of transformational leadership in empiricist (non-scientific) terms identifying the elements of a transformational leader as the following: (a) charisma, (b) inspirational motivation, (c) individualized consideration, and (d) intellectual stimulation (Burns, 1978). However, using raw inductive reasoning to set out adjectives in this fashion does not present a testable theory in Popperian terms because we do not have a testable meaning of "charisma," "inspiration," and so forth. The non-scientific nature of the theory is also evident from the impossibility of falsifying the theory, particularly as it was given by Tickle, Brownlee, and Nailon (2005) by directly linking epistemological beliefs to the theory of transformational leadership. Another illustration is an idea that great leaders are often academic underachievers. The implication is that if academic underachievers make better business leaders, then the idea may be surmised that perhaps less intelligent persons make better leaders particularly in business. All of these are inductive and non-scientific claims that do not identify an element of causation.

A neo-corporate view of leadership sometimes identifies a leader as merely a person that de facto has followers (Hollander, 1978). A corporate performance assessment based on leadership can then be reduced to a hierarchical system in particular where the object person (leader) is separated from the subject group (followers) and can be evaluated for performance separately on a particular project. However, a corporate manager with followers does not necessarily display leadership simply by taking on a corporate project. Another challenge for leadership science would be to distinguish leadership from simply management (Fairholm, 1995, p. 65). However, a leader is defined here as part of the subject group and not merely a manager separate and apart from the group. For example, the leader of a baseball team might be the captain of the baseball team and is thus part of the group which he or she sets out to lead.

The role of auxiliary hypotheses

The Bayesian understanding of science accepts most of Popperian theory with the qualification that scientific discovery does not arise solely from the falsification of hypothesis alone (Ulen, 2002). Rather, discovery seems to occur with the introduction of auxiliary hypotheses to supplement general theories. The example of the general theory of relativity to Newtonian physics is often given as an illustration of this approach. The Bayesian approach is occasionally taken as the rejection of Popperian theory. However, Popper (1935/2002) wrote that he was dealing with the logic of scientific discovery after the introduction of the hypothesis, and Popper thus accepted Einstein´s proposal of intuition in the positing of hypotheses (p. 8). Popper deals with logical deduction in the evaluating of hypotheses posed inductively. Thus, in the process of science, it often appears that supplemental hypotheses are posed to augment a general theory rather than to falsify it in its entirety.

Hence, with regard to the scientific study of anything, including leadership, hypotheses generally do not come from deduction but can be tested in part by deduction. Accordingly, the introduction of scientific hypotheses is a normative process, and the testing of hypotheses is an objective process. This is why economists, for example, usually appear to have a normative bent in the research results about controversial fields, such as taxation. The means for proposing an auxiliary hypothesis also depends on the maturity of the field of science. A scientist in the field of physics will usually set out to use an experiment to augment a general theory of physics that has already been shown with some other experiment. If an experiment has been previously applied to verify an existing theory, usually a scientist will want to see an experiment to falsify or amend it. However, in a nascent field of scientific inquiry, such as leadership, where a hypothesis is given by abduction, then it often can be rejected with the same method. This is not always the case, however, as Einstein´s introduction of the general theory of relativity clearly demonstrated. However, we can say that science does not proceed by deduction alone, and the use of abduction, induction, deduction, and empirical methods may all be part of the scientific project at different stages.

Clinicians working in a particular field are good sources of experience to draw causative hypotheses about some particular aspect of human behavior, such as leadership. The scientific method entails an identification of meaningful hypotheses for further testing. That is, the testing of the hypothesis of turtlenecks as causative of leadership might be plausible only if a clinician with knowledge of leadership reports that turtlenecks trigger a response in other people resulting in better leadership results. The necessary role of clinicians of leadership, or experts of leadership, rules out the re-emergence of Baconian empiricism where laboratory technicians might stake out an exclusive claim to the science of leadership by identification of patterns in datasets with computer programs and data crunching.

Bayesian science proceeds by the positing of auxiliary hypotheses to the general theory (Ulen, 2002). If the field of leadership studies lacks a general theory, then the existing theories of leadership may constitute auxiliary hypotheses to an unstated general theory. Thus, in the circumstance where one disagrees with an existing theory, it may be that the general theory is unappealing or that the auxiliary hypothesis is unappealing. The advantage of systematizing with the scientific method is that it becomes much simpler to say why one scientist may agree or disagree with a particular theory. The positing of auxiliary hypotheses in the context of leadership science has already occurred in the field of leadership science where a variety of theories about leadership have been proposed. Greenleaf´s (1977) servant leadership is illustrative. Greenleaf´s theory that servants can affect leadership represents a clever restatement of the idea that the relation between the leader and the subject group need not be from the position of authority.

Systematizing existing theories of leadership

Clinicians of leadership are particularly helpful in the origination of scientific hypotheses in the field of leadership science (Bogenschneider, 2015). Clinicians might be thought of as persons who have experience with effective leaders, such as coaches, military leaders, or corporate executives. Academics in the field of leadership studies are also potential clinicians insofar as they set out to identify causation. However, statisticians or economists who simply analyze data are only engaged in the evaluation of given hypotheses about leadership and not the derivation of hypotheses. In a situation of multiple theories occurring within a field of scientific inquiry (but absent any sort of general theory), it will be potentially impossible for the different participants to explain why they accept or reject the hypotheses of other scientists also working within the field. This may result in scientists ignoring one another and, particularly, ignoring others with whom they disagree.

A causal theory of leadership renders the possibility of a systemization of prior research in the field of leadership studies under the respective causal propositions: (a) Relation of Subject (Leader) to Object (Follower), (b) Undertaking the Project, (c) Project is subject to Adversity, and (d) Adversity is overcome with Decisive Effect. Each proposition is given here based (Appendix A [University of Warwick, 2012]; Appendix B) with a brief summary with a listing of the directly relatable prior research:

Relation of Subject (Leader) to Object (Follower)
(1) Leadership is the behavior of an individual when he is directing the activities of a group toward a shared goal (Hemphill & Coons, 1957, p. 7).
(2) Leadership occurs when persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation and morality (Burns, 1978, p. 20).
(3) Leadership is achieved as a form of service to others (Greenleaf, 1977).
(4) Leadership is a process of influence between a leader and those who are followers (Hollander, 1978, p. 1).
(5) Leadership is an interaction between two or more members of a group that often involves a structuring or restructuring of the situation and the perceptions and expectations of members…Leadership occurs when one group member modifies the motivation or competencies of others in the group. Any member of the group can exhibit some amount of leadership… (Bass, 1990, p. 19).
(6) Leadership requires using power to influence the thoughts and actions of other people (Zalenik, 1992).
(7) Leadership is that process in which one person sets the purpose or direction for one or more other persons and gets them to move along together with him or her and with each other in that direction with competence and full commitment (Jaques & Clement, 1994, p. 4).
(8) Leadership is the art of influencing others to their maximum performance to accomplish any task, objective or project (Cohen, 1990, p. 9).

Undertaking the Project
(1) Leadership is the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives (Yukl, 2006, p. 8).
(2) Leadership may be considered as the process (act) of influencing the activities of an organized group in its efforts toward goal setting and goal achievement (Stogdill, 1950, p. 3).
(3) Leadership is interpersonal influence, exercised in a situation, and directed, through the communication process, toward the attainment of a specified goal or goals (Tannenbaum, Weschler, & Massarik, 1961, p. 24).

(4) Leadership is an influence process that enables managers to get their people to do willingly what must be done, do well what ought to be done (Cribbin, 1981).

(5) Leadership is the process of influencing the activities of an organized group toward goal achievement (Rauch & Behling, 1984, p. 46).

(6) Leadership is the initiation and maintenance of structure in expectation and interaction (Stogdill, 1974/2004, p. 411).

(7) Leadership is an attempt at influencing the activities of followers through the communication process and toward the attainment of some goal or goals (Donelly, Ivancevich, & Gibson, 1985, p. 362).

(8) Leadership is a process of giving purpose (meaningful direction) to collective effort, and causing willing effort to be expended to achieve purpose (Jacobs & Jaques, 1990, p. 281).

(9) Leadership is aligning the interest of the organization and its members (Bass, 1999).

Project is subject to Adversity

(1) Leadership is the art of mobilizing others to want to struggle for the shared aspirations (Kouzes & Posner, 1995, p. 30).

(2) Leadership is the process of influencing the activities of an individual or a group in efforts toward goal achievement in a given situation (Hersey & Blanchard, 1988, p. 86).

(3) Leadership is a development of a clear and complete system of expectations in order to identify evoke and use the strengths of all resources in the organization the most important of which is people (Batten, 1989, p. 35).

(4) Leadership is the influential increment over and above mechanical compliance with the routine directives of the organization (Katz & Kahn, 1978, p. 528).

(5) Leaders are those who consistently make effective contributions to social order, and who are expected and perceived to do so (Hosking, 1988, p. 153).

Adversity is overcome with Decisive Effect

(1) Leadership is a process whereby an individual influences a group of individuals to achieve a common goal (Northouse, 2010, p. 3).

(2) Leadership is the accomplishment of a goal through the direction of human assistants. A leader is one who successfully marshals his human collaborators to achieve particular ends (Prentice, 1961).

(3) Leaders are individuals who establish direction for a working group of individuals who gain commitment from this group of members to this direction and who then motivate these members to achieve the direction's outcomes (Conger, 1992, p. 18).

(4) Leadership is creative problem solving (Reiter-Palmon & Illies, 2004).

(5) Leadership is enhanced effectiveness by making workers financially and spiritually secure (Fairholm, 1995).

Inapplicable (non-causal) definitions of leadership

(1) Leadership is typically defined by the traits, qualities, and behaviours of a leader (Horner, 1997).

(2) Leadership is in practice undefinable because it is largely context-dependent (Gardner et al. 2005).

Conclusion

The study of leadership is often thought of as an interdisciplinary area of research. But, what does *interdisciplinary* mean exactly? Why is interdisciplinary research perceived as advantageous particularly within the social sciences? The answer to both questions relates to

epistemology. An epistemology of leadership means a common method of knowing that spans across disciplines. In terms of scientific inquiry, the epistemology is premised on causation and not descriptive adjectives. In the circumstance where an understanding of causation is not the central goal of an academic field, then the epistemology of that field may be incommensurable with other disciplines rendering it unsuitable for interdisciplinary research. The classic example is in the field of economics where the claim is often made in the title of papers: "This is what we know about xyz" (see Auerbach, 2006; Dharmapala, 2014). As Popper (1935/2002) explained in detail, the idea that causation can only be determined by examining empirical observations (or datasets) is erroneous (p. 24). The central idea of interdisciplinary research is that scholars do not engage in epistemological "turf" claims with advancement of arguments comprising an exclusive right to know all things about a certain subject. Rather, the idea is that better understandings of causation can be derived from crossover knowledge between parallel fields of study to allow for more rapid advancements in the scientific understanding of causation. The potential for more rapid advancement of scientific research with crossover knowledge is the primary benefit of interdisciplinary research. Another advantage of leadership epistemology is that it avoids harmful discourse between disciplines, as Kuhn (1962/1996) envisioned. So, with the emphasis placed on causation, the issue of identifying the better epistemology for the study of leadership is rendered largely moot.

Nonetheless, separate academic fields may be better suited to investigate specific aspects of the complexity of social behavior. This is because social behavior is complex. Leadership science refers to the general study of causation of leadership behavior or results. The study of causation thus encompasses many academic fields at once. The various interdisciplinary fields applied in leadership studies might relate better or worse to each of the given propositions of the prior section. As such, the foregoing discussion of science developed in this paper should explain the particular appeal of interdisciplinary scholarship in the field of leadership science. For example, the relation of the leader to the group may be a matter appropriate for further investigation in the field of psychology, where the means to overcome adversity by specialized knowledge of the respective leader may relate to education studies. Hence, each of the four propositions of leadership (given here as causal epistemology) might relate better or worse to a specific field of study. The categorization of leadership studies in these terms is a coherent means of systemization within a causal epistemological framework.

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Appendix A
List of Leadership Definitions (University of Warwick, 2012)

1. Leadership may be considered as the process (act) of influencing the activities of an organized group in its efforts toward goal setting and goal achievement (Stogdill, 1950).
2. Leadership is the behavior of an individual when he is directing the activities of a group toward a shared goal (Hemphill & Coons, 1957).
3. Leadership is the accomplishment of a goal through the direction of human assistants. A leader is one who successfully marshals his human collaborators to achieve particular ends (Prentice, 1961).
4. Leadership is interpersonal influence, exercised in a situation, and directed, through the communication process, toward the attainment of a specified goal or goals (Tannenbaum, Weschler & Massarik, 1961).
5. Leadership is the initiation and maintenance of structure in expectation and interaction (Stogdill, 1974).
6. Leadership is a process of influence between a leader and those who are followers (Hollander, 1978).
7. Leadership is the influential increment over and above mechanical compliance with the routine directives of the organization (Katz & Kahn, 1978).
8. Leadership is an influence process that enables managers to get their people to do willingly what must be done, do well what ought to be done (Cribbin, 1981).
9. Leadership is the process of influencing the activities of an organized group toward goal achievement (Rauch & Behling, 1984).
10. Leadership is an attempt at influencing the activities of followers through the communication process and toward the attainment of some goal or goals (Donelly, Ivancevich & Gibson, 1985).
11. Leadership is the process of influencing the activities of an individual or a group in efforts toward goal achievement in a given situation (Hersey & Blanchard, 1988).
12. Leaders are those who consistently make effective contributions to social order, and who are expected and perceived to do so (Hosking, 1988).
13. Leadership is a development of a clear and complete system of expectations in order to identify evoke and use the strengths of all resources in the organization the most important of which is people (Batten, 1989).
14. Leadership is an interaction between two or more members of a group that often involves a structuring or restructuring of the situation and the perceptions and expectations of members…Leadership occurs when one group member modifies the motivation or competencies of others in the group. Any member of the group can exhibit some amount of leadership… (Bass, 1990).
15. Leadership is the art of influencing others to their maximum performance to accomplish any task, objective or project (Cohen, 1990).
16. Leadership is a process of giving purpose (meaningful direction) to collective effort, and causing willing effort to be expended to achieve purpose (Jacobs & Jaques, 1990).
17. Leaders are individuals who establish direction for a working group of individuals who gain commitment from this group of members to this direction and who then motivate these members to achieve the direction's outcomes (Conger, 1992).
18. Leadership requires using power to influence the thoughts and actions of other people (Zalenik, 1992).
19. Leadership is that process in which one person sets the purpose or direction for one or more other persons and gets them to move along together with him or her and with each other in that direction with competence and full commitment (Jaques & Clement, 1994).
20. Leadership is the art of mobilizing others to want to struggle for the shared aspirations (Kouzes & Posner, 1995).

Appendix B
Expanded List of Leadership Definitions

21. Leadership is typically defined by the traits, qualities, and behaviours of a leader (Horner, 1997).
22. Leadership is creative problem solving (Reiter-Palmon & Illies, 2004).
23. Leadership occurs when persons engage with others in such a way that leaders and followers raise one another to higher levels of motivation and morality (Burns, 1978: p. 20).
24. Leadership is aligning the interest of the organization and its members (Bass, 1999).
25. Leadership is achieved as a form of service to others (Greenleaf, 1970).
26. Leadership is enhanced effectiveness by making workers financially and spiritually secure (Fairholm, 1995).
27. Leadership is in practice undefinable because it is largely context-dependent (Gardner, et al. 2005).
28. Leadership is the process of influencing others to understand and agree about what needs. to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives (Yukl, 2006).
29. Leadership is a process whereby an individual influences a group of individuals to achieve a common goal (Northouse, 2010).